

SURVEY OF POWELL'S, CLINCH, AND EMERY'S RIVERS, IN
VIRGINIA AND TENNESSEE.

LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING,

In compliance with the provisions of the river and harbor act of March 3, 1875, reports of Major McFarland on the survey of certain rivers in Virginia and Tennessee.

FEBRUARY 21, 1876.—Referred to the Committee on Commerce.

AUGUST 5, 1876.—Ordered to be printed.

WAR DEPARTMENT, *February 15, 1876.*

The Secretary of War has the honor to transmit to the House of Representatives, in compliance with the provisions of the river and harbor act of March 3, 1875, copies of reports of Major McFarland on surveys of Powell's River from the three forks, in Wise County, Virginia, to the mouth of Clinch River, Tennessee; of Clinch River from the mouth of Indian, in Tazewell County, Virginia, to the junction of Clinch and Powell's Rivers, Tennessee; and Clinch River below the mouth of Emery's River, and Emery's River above its mouth, Tennessee.

WM. W. BELKNAP,

Secretary of War.

OFFICE OF THE CHIEF OF ENGINEERS,
Washington, D. C., February 12, 1876.

SIR: I beg leave to submit, in further compliance with provisions of the river and harbor act of March 3, 1875, copies of reports to this office from Maj. Walter McFarland, Corps of Engineers, of results of examinations of—

1. Powell's River from the three forks, in Wise County, Virginia, to the mouth of Clinch River, Tennessee;
2. Clinch River from the mouth of Indian, in Tazewell County, Virginia, to the junction of Clinch and Powell's Rivers, Tennessee; and,
3. Clinch River below the mouth of Emery's River, and Emery's River

above its mouth, Tennessee, made with the view of improving the navigation of those streams.

By direction of Brigadier-General Humphreys, and in his absence,
Very respectfully, your obedient servant,

JOHN G. PARKE,
Major of Engineers.

HON. W. W. BELKNAP,
Secretary of War.

UNITED STATES ENGINEER OFFICE,
Chattanooga, Tenn., February 2, 1876.

GENERAL: I have the honor to submit herewith reports upon the following examinations, ordered by act of Congress approved March 3, 1875, viz:

1st. Powell's River from the three forks, in Wise County, Virginia, to the mouth of Clinch River, Tennessee.

2d. Clinch River from the mouth of Indian, in Tazewell County, Virginia, to the junction of Clinch and Powell's Rivers, Tennessee.

3d. Clinch River below the mouth of Emery's River, and Emery's River above its mouth, for the removal of bars, Tennessee.

Very respectfully, your obedient servant,

WALTER MCFARLAND,
Major of Engineers.

Brig. Gen. A. A. HUMPHREYS,
Chief of Engineers, U. S. A.

EXAMINATION OF POWELL'S RIVER FROM THE THREE FORKS, IN WISE COUNTY, VIRGINIA, TO THE MOUTH OF CLINCH RIVER, TENNESSEE.

By the wording of this act it will be observed that the examination was to be extended to the mouth of the Clinch River, which is 106 miles (estimated) below the point at which Powell's River empties into it. As the same act of Congress requires, however, the examination of the remaining part of the Clinch, above the mouth of Powell's River, I have thought it best to restrict this report to the examination of Powell's River only, leaving the examination of the lower part of the Clinch to be included in the report upon that river.

From the three forks, in Wise County, Virginia, where the examination was begun, Powell's River runs in a southwesterly direction about one hundred and ninety miles (estimated) to its junction with the Clinch; seventy miles of this length lying in Virginia, and the remaining one hundred and twenty miles in Tennessee.

The valley through which this river flows is surrounded, except to the southward, by ridges and spurs of the Cumberland Mountains, which render it almost inaccessible. It has no railroad facilities.

The river forms its only outlet, and this is narrow, crooked, and so much obstructed by bars, rocky ledges, snags, shoals, mill-dams, and fish-traps that it requires a rain-tide of five or six feet to enable flat-boats to pass down it. It cannot be used at all during the season of low water; and during the season of navigation, which is limited to the winter and spring months, if, as sometimes happens, only two or three boating-tides occur, much of the produce of the valley is left on the farmers' hands, to their great injury.

The region watered by Powell's River and its tributaries is a very fertile one, containing some of the best farming-lands in Virginia and Tennessee, and its annual produce of wheat, corn, oats, bacon, and other farm-products is valued at over \$1,000,000, independently of its timber, iron, and coal. None of this latter is shipped. Not less than one hundred and twenty or one hundred and thirty flat-boats, with cargoes valued at from one thousand to five thousand dollars, come annually out of Powell's River.

Assistant Engineer William M. Gordon, who made this examination, reports that the fall in the lower part of the river is too great, and the supply of water during the summer and autumn too little, to admit of its adaptation to low-water navigation.

All that can be done, then, and all that is asked, is to so improve the high-water navigation that boats may be able to pass out on rain-tides of $3\frac{1}{2}$ or 4 feet. This would increase the safety of the navigation during the higher tides, and would render available for boating many rain-tides, which in the present condition of the river are useless for that purpose.

This could be accomplished by breaking off the points of the ledges which project above low water, blasting and removing the large bowlders which have fallen into the channels, cutting away some points, removing overhanging trees, snags, dams, and fish-traps, and, in a few cases, building wing-dams for the purpose of confining the channel to narrower limits.

The estimated cost of this work is as follows, viz :

For that part of the river lying in Virginia below Shaver's Ford, (above which the character of the river forbids any attempt at improvement,) length, forty miles	\$4, 590
For that part lying in Tennessee, length one hundred and twenty miles.....	15, 410
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	20, 000
Superintendence, contingencies, &c., 25 per cent.....	5, 000
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Total	25, 000

For more detailed information upon this subject, reference should be made to the report of Assistant Gordon, which is hereto appended :

REPORT OF MR. WILLIAM M. GORDON, ASSISTANT ENGINEER.

Powell's River rises in Wise County, Virginia, and, following a general south-west course through Lee County, Virginia, enters Tennessee, and either passing through or touching Hancock, Claiborne, Union, Campbell, and Anderson Counties, empties into Clinch River about thirty-five miles above Clinton. The principal affluents on the north are Stone Fork, North Fork, Trading Creek, Four Mile, Davis Creek, and Cedar Creek, and, on the south, Station Creek, Wallen's Creek, Mulberry Creek, and Hoop Creek; many smaller ones come in on both sides. For properly understanding the character of the river, I will divide it into four sections, and describe them in order.

Section I embraces that portion from the mouth of South Fork, in Wise County, to Shaver's Ford, in Lee County, Virginia, a distance of about thirty miles.

Section II includes that part from Shaver's Ford to White Shoals, in Lee County, about twenty-eight miles.

Section III extends from White Shoals to the mouth of Hoop Creek, in Claiborne County, Tennessee, a distance of about thirty-five miles.

Section IV embraces the part from Hoop Creek to the junction with Clinch, in Anderson County, Tennessee, a distance of some ninety-six miles.

The distances, as given above, were merely estimated, the estimates being based partly on my own judgment and partly on information derived from persons living on the river. To correct any supposed error the figures should be increased.

Beginning at the mouth of South Fork, the river for the first six miles is about 125

feet wide, varies in depth from 2 to 5 feet, has a moderate current, no abrupt bends, and few obstructions. We here reach Ollinger's Mill-dam, with a fall of about 6 feet. From this point a marked change takes place in the character of the river; the channel becomes contracted; the shoals and rapids are greatly multiplied, the fall being much greater; many short and abrupt bends occur, with perpendicular, jagged limestone cliffs opposite the points; great numbers of bowlders have fallen from the bluffs and lie strewn along the bed; numerous islands obstruct the water-way, dividing it into very narrow channels; and, within a distance of twenty-five miles, five mill-dams are met with, having an aggregate fall of 30 feet. Boats have never run on this portion of the river, as far as I could learn. The affluents are small, making it appear that the mills are a necessity in their present position. A large amount of money would be required to clear out the obstructions and build aprons to the dams, and if all other obstacles were removed, the current is so rapid and the bends so sharp that I think few persons would be found bold enough to trust their property to be carried over this part of the river. The farmers living on the upper part find ready sale for their surplus productions to the citizens of Wise, and those living lower down can easily haul their produce eight or ten miles to Shaver's Ford.

In view of these facts, I have not included Section I in my estimate; but have considered Shaver's Ford as the proper head of navigation.

From Shaver's Ford, the beginning of Section II, the river is still rather narrow for eight or ten miles; but the current is much less rapid, very few islands are met with, the bends are more gradual, and few obstacles are found. Fifteen or twenty boats leave here annually. The river gradually widens and deepens until we reach White Shoals.

At this point the river turns more to the west and runs more nearly through the center of the valley. To the mouth of Hoop Creek it is broad and deep, with little current; the shoals have inconsiderable fall, except at a few places, notably the Bag-string and Parrett's Chute; the bends are very gradual and sweeping, and for almost the entire distance we have a beautiful river.

From Hoop Creek to its junction with Clinch the river is still broad, but not so deep; the fall becomes greater than in the last section, with an almost continuously brisk current, which at times becomes rapid; the islands are more numerous and the navigation more dangerous.

Powell's River, running as it does through the mountains, is necessarily very tortuous, bends occurring at every few hundred yards, and sometimes, as at Nevel's Shoals, after running a distance of three miles, returns so nearly upon itself that the space across the neck is only a few hundred feet.

OBSTRUCTIONS.

In 1845 the State of Tennessee expended within her limits about \$7,000 in the removal of some of the most dangerous rocks and fish-dams, and in building wing-dams at some of the islands and shoals.

A considerable amount of work was done, and the navigation was greatly improved. The boatmen in Virginia banded together a few years ago and removed some of the most dangerous obstacles, thus showing a disposition to help themselves. Still, much remains to be done. Large masses of rock have become detached from the cliffs and fallen into the river; fish dams and traps have been rebuilt in defiance of law, and the wing-dams, originally built of the round bowlders found in the river, and on too small a scale, have in most cases been entirely destroyed by drift-logs and the current.

The obstructions now found in the river may be classified as follows:

Ledges of rock running across the river, and showing sharp points above low water.

Large bowlders that have fallen from the bluffs.

Shoals of smaller bowlders and gravel.

Islands dividing the water-way into narrow channels.

Rocky points extending into the river at the bends, and mostly covered with small trees and brush.

Leaning trees and hanging limbs; snags.

Fish dams and traps.

Mill-dams.

PLAN OF IMPROVEMENT.

The ledges of rock which cross the river in very many places are mostly limestone; some sandstone was found. These ledges have points more or less sharp, projecting above ordinary low water to the height of a foot or more, and are very dangerous; they should be broken down by the hammer and wedge, or by blasting to the low-water mark.

The large bowlders have fallen from the cliffs, loosened by the action of water and frost, and lie scattered along the whole length of the river. These should be broken

up with powder, and the fragments removed to the bank, except when they fall into deep water.

The larger boulders (those that show above ordinary low water) found on the shoals should be moved out of the channel; this can readily be done by hand. At most of the islands and some of the shoals, as at Potut's Island, Farley's Shoals, Parrett's Chute, mouth of Mulberry, Hook Creek, Nevel's Shoals, Cox's Shoals, Jack Nantz's Shoal, Island Ford, Bradin's Shoals, Baker's Tow-head, Ridenhour's Island, and Poor Horse Island, wing-dams should be built to turn the water into the boating channel.

Many of the points at the bends project into the river, lessen the water-way, and force boats to make too wide a circuit, thus rendering them liable to be thrown on the opposite bank below. Their removal would greatly lessen the dangers of navigation.

Leaning trees and hanging limbs are found at almost all the points, and on many of the stretches, especially in the upper river. Their removal is a necessity. The trees should be felled, trimmed of their branches, and then cut up into pieces 10 feet in length, to be borne off by the tides and deposited out of the way of boats.

Snags are frequently found, especially in the lower river. Almost all persons in clearing the banks merely cut the trees, allowing them to fall with tops in the water, the butts resting on the land, and to remain in this condition until the first rain-tide swings them off. The whole trees float slowly down the stream, to be caught probably on the first shoal or in the first eddy, and form dangerous snags. These should be removed, and it should be made imperative on all persons cutting trees into the river to lop off all the limbs, and cut the trunks into lengths not exceeding 10 feet, so that when the water rises, the parts would separate and be deposited where they could do no harm.

In the most dangerous class of obstructions must be placed fish-dams and traps, generally built by irresponsible and ignorant persons having a total disregard for the rights and the safety of the property of others. The traps are often placed in the best boating channel; and being built and repaired in low-water season, boatmen have no means of knowing where they are until a fatal accident occurs. I found no less than sixty-five traps, old and new, in the navigable portion of the river. Boatmen generally prefer one of the several chutes around islands and over shoals, but it is not always possible to choose; the wind may blow them off, or an oar may break in working into the proper position to enter the selected channel, and it may then be necessary to run the other, which should be unobstructed as far as possible. Hence all dams and traps should be removed, and it should be made a penal offense for any person to build another one in any part of the river.

I found three mill-dams in partial decay, and one in repair below Shaver's Ford. The latter is attached to a saw-mill belonging to Mr. Frank Holliday, in Lee County, and has a fall of four feet. Mr. Holliday was not at home, but I learned the dam was erected about 1872, twenty-five years after the river was first used for boating purposes. The mill is a mere frame structure and the business moderate. I learned also that suit was brought to compel its removal, and Holliday had given bond in the sum of \$5,000 to make good any loss that may be caused by its erection. No accident has occurred, for the simple reason that boatmen prefer to wait for a high tide, to running any risk, as it is more than probable that should a boat be broken up on it, long and vexatious litigation would result before damages could be recovered. I saw but one man who spoke of it with favor, and he lives and does business below the dam. Of course it does not interfere with his operations. I spoke to several boatmen on this subject, and all told me they approach it at all times with dread, and thank their good fortune when it is passed in safety. There is a considerable fall just below the dam, and the water is drawn off rapidly, thus rendering it more dangerous.

I recommend its removal, for it seems to me useless to spend money on minor obstructions and leave the most serious one intact.

I would recommend that landing-places be prepared for boats every six or eight miles. These landings would be a great convenience—in fact, are a necessity, for boats are sometimes lost in attempting to land at unsuitable places on the approach of night or during high winds. I would merely select some soft bank, where there is eddy-water, and remove the trees, brushes, stumps, &c., for an area of say 150 feet long by 20 feet wide. This would be ample; for as each boat arrives it could be brought to the bank, stopped, and then dropped down the stream, making room for others that might follow. In the present condition of the river, boats frequently have to stop an hour or two before sundown, or run after night, which is always attended with danger, to find a suitable landing-place. The cost would be a mere trifle.

COST OF IMPROVEMENT.

In estimating the cost of improvement I think it best to consider the amounts required in the two States separately.

Estimate of cost of improving Powell's River in Virginia, for high-water navigation by flat-boats, a distance of about forty miles.

Removing ledges	\$100
Removing large bowlders	580
Removing small bowlders from shoals	360
Removing rocky points, and cutting leaning trees and hanging limbs	1,000
Removing fish dams and traps	200
Removing mill-dams	750
Removing snags	50
Building wing-dams, 500 cubic yards	1,500
Cutting trees and grubbing, for landings	50
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	4,590

Estimate of cost of improving Powell's River in Tennessee for a distance of about one hundred and twenty miles.

Removing ledges	\$1,430
Removing large bowlders	1,320
Removing small bowlders from shoals	750
Removing rocky points, and cutting leaning trees and hanging limbs	540
Removing fish dams and traps	280
Removing snags	250
Removing mill-dams	80
Building wing-dams, 3,520 cubic yards	10,560
Cutting trees and grubbing, for landings	200
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	15,410

Summary.

Estimate of cost of improvement in Virginia	\$4,590
Estimate of cost of improvement in Tennessee	15,410
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	20,000
Contingencies, 10 per cent.	2,000
Engineering and supervision	2,000
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Total cost	24,000

RESOURCES OF THE COUNTIES CONTIGUOUS TO POWELL'S RIVER.

The country drained by Powell's River and its tributaries is rich and productive, embracing some of the finest farming-lands in the Southwestern Virginia and North-eastern Tennessee. Wheat, corn, oats, bacon, and other farm-products are shipped annually in large quantities: not less than one hundred and twenty-five flat-boats, with cargoes valued at from \$800 to \$5,000, come out of Powell's River every winter and spring. Pig-iron is shipped from the Cumberland Gap furnace to Chattanooga by this route. Valuable timber is found on the whole length of the river; large quantities are rafted out every year. Coal is found in abundance, but no effort has been made to ship it, in consequence of high rates of freight.

The following table is made from the census returns of 1870, and shows in part the productions of the counties along the river:

Counties.	Popula- tion.	Wheat.	Corn.	Oats.	Potatoes.	Wool.	Tobacco.
		<i>Bush.</i>	<i>Bush.</i>	<i>Bush.</i>	<i>Bush.</i>	<i>Lbs.</i>	<i>Lbs.</i>
Lee, Virginia	13,268	81,600	368,000	67,000	18,200	21,800	(*)
Hancock, Tennessee	7,148	22,900	204,000	41,300	13,900	13,900	9,978
Claiborne	9,321	33,900	205,000	59,000	15,000	15,300	4,827
Union	7,605	29,600	168,600	69,800	(*)	10,600	14,169
Campbell	7,445	18,400	127,000	65,200	12,500	12,000	8,509
Anderson	8,704	22,900	263,000	73,000	22,000	13,000	15,578
Totals	53,491	209,300	1,335,600	375,300	81,600	86,600	53,061

* Not given.

From extended inquiries I am inclined to think the production of cereals has greatly increased in the last two or three years.

REASONS FOR THE IMPROVEMENT.

The people living in Powell's Valley are literally surrounded by mountains, except to the southward. They have the Cumberland Mountains on the west, Wallen's Ridge and Clinch Mountains on the east, and the high watershed which divides the waters of Powell's River from those of Sandy on the north. There are no railroad facilities; wagon transportation east, north, or west is entirely out of the question, and they are absolutely dependent on Powell's River for an outlet to market. Neither Virginia nor Tennessee is able to undertake any plan looking to the improvement of the river, and the people have helped themselves as far as they are able. In the present condition of the river five and six feet rain-tides are necessary to enable boats to make the trip down, and the annual loss of property is something over 6 per cent. It sometimes happens that only two or three of these boating tides occur during the season, consequently much produce is left in the country, to the great loss of farmers, for every man cannot build and run a boat. If the suggested improvements are made, boats could run out on $3\frac{1}{2}$ or four feet tides with less danger than now threatens, the season of navigation would be prolonged, and advantage taken of a favorable market.

W. M. GORDON,
Assistant Engineer.

Maj. WALTER MCFARLAND,
Corps of Engineers.

EXAMINATION OF CLINCH RIVER FROM THE MOUTH OF INDIAN, IN TAZEWELL COUNTY, VIRGINIA, TO THE JUNCTION OF CLINCH AND POWELL'S RIVERS, TENNESSEE.

This report covers also the examination of the remaining part of the Clinch River, extending from the mouth of Powell's River to the Tennessee River, a distance of about one hundred and six miles, ordered by the same act of Congress, in the clause directing the examination of Powell's River.

From the mouth of Indian Creek, which it receives from the north, in Tazewell County, Virginia, the Clinch River flows in a southwesterly direction for nearly four hundred miles to its junction with the Tennessee River; one hundred and sixty-five miles of its course lying in the State of Virginia, and two hundred and thirty miles of it in the State of Tennessee.

Powell's River enters it from the north at a point about one hundred and six miles above its mouth.

Like Powell's River, the Clinch is almost surrounded by ridges and spurs of the Cumberland Mountains, which render its valley almost inaccessible; and the general characteristics of the two streams and of the regions through which they flow are the same.

The Clinch, like Powell's River, is narrow, crooked, made up of pools and shoals, and obstructed by rocky ledges and points, bars and shoals of gravel, scattered bowlders, snags, mill-dams, fish-traps, and overhanging trees.

It has the same seasons of high and low water, the boating tides occurring only in the winter and spring months, with the same irregularity and uncertainty as in Powell's River, and with the same consequent injury to the farmers when these tides are not numerous enough to enable them to remove their entire crops.

The valley is equally fertile and rich in resources, the value of its farm-products annually exported being about \$2,000,000. Over one hundred and fifty flat-boats, with cargoes ranging from \$1,000 to \$5,000 in value, annually descend the Clinch on boating tides of five or six feet. The upper part of the river, from the mouth of Indian Creek, in Tazewell County, Virginia, to Nash's Ford, in Russell County, Virginia, a distance of seventy-five miles, is not susceptible of improvement.

Laden flat-boats have passed down from Nash's Ford to Kingston, on the Tennessee River, at the mouth of the Clinch, a distance of three hundred and twenty miles; but Osborn's Ford, in Scott County, Virginia, fifty-five miles farther down and thirty-five miles by river from the boundary-line between Virginia and Tennessee, is regarded as the head of high-water navigation on the Clinch. It has no low-water navigation. No part of the river can be fitted for low-water navigation except, perhaps, the part lying below Walker's Ferry, in Grainger County, Tennessee, one hundred and forty-five miles above the mouth of the Clinch. It is possible that from here to Clinton, a distance of seventy-four miles, a low-water depth of $1\frac{1}{2}$ feet, and from Clinton to the mouth, a distance of seventy miles, a low-water depth of 2 feet, might be secured; but this question can be settled only by making a careful survey of this part of the river. At present there appears to be no necessity for any such improvement, even if it be found practicable to make it.

All that can or should be done, then, for the present, is to improve the high-water navigation of this river, so that there shall be less difficulty and danger in bringing out cargoes, and so that rain-tides of 3 or 4 feet may be made use of for boating purposes.

This can be done by breaking off the points of rocky ledges, blasting and removing the bowlders which are in the way of boats, deepening the channels over some of the bars, removing fish-traps, mill-dams, snags, and overhanging trees, and contracting the channel occasionally by the use of wing-dams. This improvement should begin at Nash's Ford, and should extend to the mouth of the Clinch, three hundred and twenty miles.

The estimated cost of it is as follows:

Nash's Ford to the boundary-line between Virginia and Tennessee, ninety miles	\$14,100
Boundary-line to mouth of Clinch, two hundred and thirty miles	21,120
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Contingencies, &c., 25 per cent.	35,220
	8,805
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Total	44,025

For further information as to the examination of this river, reference may be made to the report of Assistant Engineer William M. Gordon, which is sent herewith:

REPORT OF MR. WILLIAM M. GORDON, ASSISTANT ENGINEER.

Having completed the field-work on Powell's River July 14, I immediately started for the mouth of Indian, in Tazewell County, Virginia, to begin the examination of the Clinch; but the floods of July occurring, it was not until the 9th of August that the river was sufficiently low and clear for the work to be commenced. The trip down the river was made in a canoe guided by two men. Clinch River rises in Tazewell County, Virginia, and flowing southwest through Russell and Scott Counties enters Hawkins County, Tennessee, and continuing the same general course passes through or touches Hancock, Claiborne, Grainger, Union, Campbell, Anderson, Knox, and Loudon Counties, and empties into the Tennessee River at Kingston, in Roane County. Its principal affluents are Indian, Bull Creek, Guest's River, Strong Creek, North Fork, Sycamore Creek, Powell's River, Poplar Creek, and Emery's River on the north, and Maiden Spring Fork, Big Cedar Creek, Copper Creek, Big War Creek, and Bull Run on the south. Many smaller streams flow in from either side. For convenience of description and reference the river may be divided into four sections.

Section I includes that part from the mouth of Indian, in Tazewell County, to Nash's Ford, in Russell County, Virginia, a distance of about seventy-five miles.

Section II extends from Nash's Ford to Osborn's Ford, in Scott County, Virginia, about fifty-five miles.

Section III embraces that portion from Osborn's Ford to Walker's Ferry, in Grainger County, Tennessee, a distance of about one hundred and twenty miles.

Section IV includes the remaining part of the river to Kingston, about one hundred and forty-five miles.

In the upper portion of section I the river is narrow and shallow, nothing more than a large creek. Receiving the Maiden Spring Fork and other streams, it increases in size and assumes a bolder character; the fall becomes much greater, the bends very abrupt, and in many places where the river passes around the north end of Copper Ridge, the water dashes over the ledges and down the falls with the force and rapidity of a mountain-torrent, entirely precluding the possibility of safe navigation.

At Nash's Ford, which is about six miles north of Lebanon, the county-seat of Russell County, a great change takes place; the river becomes broad, the pools long and deep, with little current, the fall on the shoals moderate, the bends are gradual, and for forty miles we have a fine stream. The first obstruction of any importance is "The Falls." This is a ledge of rock crossing the river at the foot of a large pool; it crosses at an angle of about 45° and has a fall of 3 feet. The current is not rapid either above or below, and the water is not drawn off rapidly. Persons living near told me that during what would be called a moderate boating tide no great disturbance is occasioned by it. It can be easily improved for navigation. The next obstacle of importance is at Hanging Rock Falls. The river here is impeded by very large masses of rock that have fallen from the cliffs on either side; the removal of these to low-water mark would make it entirely safe, the fall being nowhere abrupt and only about 2 feet in 100 feet, with eddy-water below.

The river now becomes narrower and rougher, having Pine Ridge on the left and the Bull-Creek Hills on the right. For a distance of four or five miles the pools are shorter, the fall on the shoals is much greater, the current in some places being very rapid; large boulders are numerous, and rock-points jut out into the river, but there are no abrupt bends such as occur in the upper river, and no physical conditions exist to prevent its improvement for safe navigation. Mr. Samuel Nash, who lives near Nash's Ford, told me his father, about 1820, sent from that point two flat-boats loaded with corn to Kingston, and in 1824, when his death occurred, was preparing to build four others to make the same trip.

Several families have moved from Russell County to the West via the Clinch and Tennessee Rivers, thus showing that this portion of the river in its unimproved condition has been used with success. To Osborn's Ford the river is in good condition. The improvement of this section would give easy and cheap outlet to a large and productive portion of Russell County, now practically cut off from market. Osborn's Ford, in Scott County, is practically the head of navigation. For the first fifty miles of this section the river is generally broad and deep, with few shoals and little fall, except at "The Rounds" and over Rogers's Shoals. Then for thirty miles it passes between Copper Ridge on the left and Chestnut Ridge on the right, and is known as the Thirty-mile Shoal. The river through the ridges is still wide, but not so deep as above, and has more fall, but no obstacles of a serious character are found. After passing the ridges the river widens and deepens and the fall becomes less to Walker's Ferry.

From Walker's Ferry to Kingston there is the usual succession of pools and shoals; a greater number of islands is seen, but no very serious obstructions are met with.

In 1845, the State of Tennessee expended \$10,000 in improving Clinch River from the State line to its mouth, but the work was not thoroughly done. Many boulders have fallen in since or were not moved at the time, fish-traps and mill-dams have been built, the wing-walls erected have been washed away, and at present the estimated amount of money could be very profitably expended. In 1872, the legislature of Virginia granted a charter to the Clinch River Improvement Company, but gave no money. About \$1,000 have been expended by the company within the limits of the State, and much good has been accomplished.

Only one mill-dam was found between Nash's and Osborn's Fords. This is at Ruin Island, about two miles above the latter place, and is a mere loose-rock structure. From Osborn's Ford to the Tennessee line there are two mill-dams belonging to George Craft and Claiborne Neeley, respectively. Craft's dam is located at the head of a shoal, is from one and a half to three feet high, and runs partly across and down the stream; it supplies water for a grist and saw mill built about thirty years ago. Business moderate. Neeley's mill is a small sash-saw affair built about four years ago. The Clinch River Improvement Company tore down a portion of the dam two years ago, but last winter a boat loaded with grain was lost by striking upon it. Suit was instituted by the owners, and the value of the boat was recovered; another suit for the recovery of the value of the grain is still in progress. This dam is very dangerous, being built at the head of a bad, rocky shoal, with considerable fall, and from which the water is drawn off rapidly. In Tennessee two small dams were passed.

The obstructions found in the Clinch are of the same character as those noticed in Powell's River.

The same classification and the same plan of improvement may be adopted, and it only remains to estimate the cost of removal.

Estimate of cost of improving Clinch River for flat-boat navigation at high water, from Nash's Ford, in Russell County, to Osborn's Ford, in Scott County, Virginia, a distance of about fifty miles.

Removing ledges	\$1,970 00
Removing large bowlders	2,630 00
Removing smaller bowlders from shoals	585 00
Removing rock points and cutting leaning trees and hanging limbs	2,660 00
Removing fish traps and dams	80 00
Removing snags	50 00
Removing mill-dam	25 00
Building wing-dams	4,960 00
Cutting trees and grubbing, for landings	30 00
	<hr/> 12,990 00

Estimate of cost of improving Clinch River from Osborn's Ford to the Tennessee line, about thirty-five miles.

Removing ledges	\$10 00
Removing large bowlders	245 00
Removing smaller bowlders from shoals	75 00
Removing rocky points and cutting leaning trees and hanging limbs	10 00
Removing fish dams and traps	30 00
Removing snags	60 00
Removing mill-dams	650 00
Cutting trees and grubbing, for landings	30 00
	<hr/> 1,110 00

Estimated cost of improving the Clinch River from the Tennessee line to Kingston, about two hundred and thirty miles.

Removing ledges	\$650 00
Removing large bowlders	1,200 00
Removing smaller bowlders from shoals	150 00
Removing rocky points and cutting leaning trees and hanging limbs	100 00
Removing fish traps and dams	300 00
Removing snags	500 00
Removing mill-dams	120 00
Building wing-dams	17,850 00
Cutting trees and grubbing, for landings	250 00
	<hr/> 21,120 00

Summary.

Estimate of cost from Nash's to Osborn's Ford, 55 miles	\$12,990 00
Estimate of cost from Osborn's Ford to Tennessee line, 35 miles	1,110 00
	<hr/>
Cost in Virginia	14,100 00
Cost in Tennessee	21,100 00
	<hr/>
	35,220 00
Contingencies, 10 per cent	3,520 00
Engineering and supervision	2,000 00
	<hr/>
Total cost	40,740 00

The following table, compiled from the census returns of 1870, shows some of the productions of the counties contiguous to Clinch River:

Counties.	Popula- tion.	Wheat.	Corn.	Oats.	Potatoes.	Wool.	Tobacco.
		<i>Bushels.</i>	<i>Bushels.</i>	<i>Bushels.</i>	<i>Bushels.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Russell, Virginia	11,103	41,000	206,000	56,000	9,000	27,000	17,282
Scott, Virginia	13,036	53,600	222,000	68,700	13,000	24,200	16,557
Hawkins, Tennessee	15,837	138,900	466,500	112,300	18,800	26,100	12,370
Grainger, Tennessee	12,421	78,100	153,300	86,000	20,300	16,000	16,646
Roane, Tennessee	15,622	74,800	504,600	112,000	24,400	14,000	350
Loudon, (new county)							
	<hr/> 68,019	<hr/> 386,400	<hr/> 1,552,400	<hr/> 435,000	<hr/> 85,500	<hr/> 107,300	<hr/> 63,205

The same reasons may be urged for the improvement of the Clinch as were given in my remarks on Powell's River. Clinch Valley runs parallel with Powell's Valley, and is in like manner inclosed by mountains, and all produce must seek a market by Clinch River.

About one hundred and fifty flat-boats come out of Clinch River annually, and there is a loss of about 6 per cent. from accidents. A large number of rafts are also brought down, but even an approximate estimate of the quantity of lumber produced cannot be made for want of proper data. Coal and iron abound.

W. M. GORDON,
Assistant Engineer.

Major WALTER MCFARLAND,
Corps of Engineers.

EXAMINATION OF CLINCH RIVER BELOW THE MOUTH OF EMERY'S RIVER, AND EMERY'S RIVER ABOVE ITS MOUTH, (FOR THE REMOVAL OF BARS,) TENNESSEE.

Emery's River is a small stream which flows from the north and enters the Clinch River four miles above its mouth.

Barton's Landing, seven miles and a half above the mouth of Emery's River, is the head of navigation, although on very high rain-tides steamers have sometimes passed up to Emery's Gap, four miles above, where the Cincinnati Southern Railroad, now in course of construction, is to bridge the river. Above Barton's Landing there are numerous falls in the river. Below it there are many boulder-bars, with from six to twelve inches of water over them. If the river were improved by giving it channels 60 feet wide and 2 feet deep, it would be necessary, in order to make them available, to construct a wing-dam 800 feet long in the Clinch River, below the mouth of the Emery's. The estimated cost of this work would be—

Improving channels	\$10,500
Wing-dam in Clinch	3,600
	<hr/> 14,100
Contingencies, &c., 25 per cent.	3,525
Total	<hr/> 17,625

There appears to be no good reason for undertaking this improvement. An iron-furnace was constructed some years ago at Oakdale, with a landing on the river about five miles from the mouth, but it has never been used—at least, it has produced no iron.

The valley does not appear to be a very productive one, and such produce as it sends out is readily carried over good roads to Kingston, on the Tennessee, only seven miles and a half distant from Barton's Landing.

No public interest demands the improvement.

For details of the examination of this river, see the report of Assistant Engineer W. M. Gordon, herewith.

REPORT OF MR. WILLIAM M. GORDON, ASSISTANT ENGINEER.

In connection with Clinch River, it was made my duty to examine Emery's River for the removal of bars.

Emery's River rises in Morgan County, Tennessee, and, flowing southeast, empties into the Clinch about four miles above Kingston; Little Emery is the principal affluent. Barton's store and landing, seven and a half miles above the mouth, and about the same distance by wagon-road from Kingston, may be considered the head of navigation, as at this point there is a fall of 1 foot perpendicular, with numerous shoals and

falls above. On very high tides, steamers go to Emery's Gap, four miles above, but the river is narrow and crooked. Such trips are not frequent. The Cincinnati Southern Railroad will cross the river at the gap.

At Cooper's Landing, one and a half miles below Barton's, is a store and hotel, with a few scattering houses. Oakdale Landing, half a mile below Cooper's, has a store-house and one dwelling. The current of Emery's River below Barton's Landing is very sluggish; in fact, except at two places, it is hardly practicable. The water in the pools is from 6 to 15 feet deep. Numerous bars rise suddenly from the deep water, and as suddenly disappear. These bars are composed of rounded bowlders, from 6 to 18 inches in diameter, though near the mouth much larger ones are found. One bar is 200 feet long, with only 6 inches of water on it; another is 370 feet long, with an average of 8 inches; and others from 20 to 250 feet in length, with 1 foot of water at low summer stage.

Ledges of rock cross the river at various points, but nowhere approach the surface nearer than 2 feet, except at the mouth of Little Emery and at a point about 600 feet below. At the former place the bar is of stratified limestone, 95 feet long, extends entirely across the river, and has only 6 inches of water on it. At the latter place the bar is 140 feet long, and has a channel depth of 18 inches. My estimate of cost is based on giving a low-water channel 60 feet wide and 2 feet deep. Should greater depth be required the cost would be largely increased, as many bars and ledges not included in the present estimate would have to be considered. To enable boats to reach the mouth of Emery's River a wing-wall about 800 feet long would have to be built on the shoals, below Green's Ford, on Clinch River.

Estimate of cost of improving Emery's River from Barton's Landing to its junction with Clinch, and Clinch River from the mouth of Emery's to the Tennessee River, to give 2 feet of water at low summer stage 11½ miles.

Removing ledges, 510 cubic yards, at \$10.....	\$5, 100
Removing bars, 5,300 cubic yards, at \$1.....	5, 300
Removing rocky points.....	75
Removing leaning trees and hanging limbs.....	25
Building wing-wall in Clinch River, 1,200 cubic yards, at \$3.....	3, 600
	<hr/>
Contingencies, 10 per cent.....	14, 100
Engineering and supervision.....	1, 400
	<hr/>
Total cost.....	16, 500

Emery's Valley does not seem to be very productive, and, from all I could learn, no great amount of produce is shipped. There has been greater activity on the river this season than usual in the transportation of supplies for the contractors on the Cincinnati Southern Railroad, but this demand is only momentary.

About one mile from Barton's Landing are several coal-mines, having a tram-way to the river, but no special activity was observed. Several years ago a large iron furnace was erected about four miles from Oakdale Landing, but has produced no iron.

In view of the fact that the whole of Emery's Valley has easy access by wagon-transportation to Kingston and a market, and that only very limited interests are involved, I cannot recommend the improvement of Emery's River.

CONCLUDING REMARKS.

In your communication of June 22, above referred to, I find the following:

"You will observe that in the instructions relating to the examination of the Hiawassee and Little Tennessee Rivers, a channel depth of 3 feet at low water is spoken of. This is the depth which is being secured for the Tennessee, and if it were possible it would be well to secure it for all the branches of the Tennessee; and this you will please bear in mind in making your examinations and report upon the possibility of securing this depth in the Clinch, Emery's, and Powell's Rivers, or the possibility of securing a depth of 2½ feet or 2 feet, or 1½ feet at low water. Report also on the probability or improbability of securing slack-water navigation on these rivers, and whether it is worth while to attempt a survey for this purpose."

My report on Emery's River covers these points so far as that river is concerned.

The fall in the lower portion of Powell's River is too great, and the supply of water in the summer and fall too limited, for low-water navigation, and, indeed, I see no necessity for attempting to secure it.

From Walker's Ferry to Clinton a depth of 1½ feet, and from Clinton to Kingston a depth of 2 feet at low water *might* be secured; but this fact can only be definitely

determined by an elaborate survey, involving the frequent gauging of the river and making numerous soundings on the shoals.

The accomplishment of any plan of improvement looking to this result could only be secured by a large expenditure of money, and its necessity is not apparent, though I was told that large timber used in the construction of flat-boats is becoming scarce along this portion of the river.

Clinton, the only town on any of these rivers, is connected with Knoxville by the Ohio and Knoxville Railroad. The railroad bridge over the Clinch at Clinton is a simple Howe truss of four spans, two of 150 feet and two of 120 feet each; the bottom chord is about 51 feet above low water. It has no draw.

Slack-water navigation could be secured on the Clinch, but the interests involved do not seem to justify the expense, and I see no necessity for making a survey with a view to such improvement.

W. M. GORDON,
Assistant Engineer.

Maj. WALTER MCFARLAND,
Corps of Engineers.

